Amendments to the Specification

No amendments are made herein to the Specification.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

1. (Previously presented) The method for simulating dental procedures for training dental students comprising, in combination, the steps of:

storing volumetric data defining the location of at least one isosurface in a model of a tooth,

storing point data defining the positions of a plurality of feel points that define the surface of a model of a dental tool having a handle,

employing a digital computer consisting of a processor and a display device to display said model of a tooth,

employing said processor and said display device to display said model of a dental tool having a handle, and

employing a haptic interface device including a force-feedback stylus that is manually moveable by a dental student and is coupled to said digital computer to move the said model of a dental tool with respect to said model of a tooth, and

employing said processor to compare said location of at least one isosurface in said model of a tooth with said positions of said feel points that define the surface of a model of a dental tool having a handle to calculate and apply computer-controlled interaction forces to said force-feedback stylus to simulate the feel of said dental tool having a handle to haptically simulate a dental procedure.

2. (Previously presented) The method set forth in claim 1 wherein said dental tool is a pick having a pick handle and wherein said force-feedback stylus is movable by said dental student to simulate the motion of said pick handle.

3. (Previously presented) The method set forth in claim 1 wherein said dental tool is a drill having a drill handle and wherein said force-feedback stylus is movable by said dental student to simulate the motion of said drill handle.

4. (Previously presented) The method set forth in claim 1 wherein said dental tool is an amalgam carrier having a carrier handle and wherein said force-feedback stylus is movable by said dental student to simulate the motion of said carrier handle.

5. (Previously presented) The method set forth in claim 1 wherein said dental tool is a carver having a carver handle and wherein said force-feedback stylus is movable by said dental student to simulate the motion of said carver handle.

6. (Previously presented) The method set forth in claim 1 wherein said model of a dental tool is selected by said student from a plurality of available dental tools, each of which has a handle, and wherein said force-feedback stylus is movable by said dental student to simulate the motion of the handle of each of said tools.

7. (Original) The method set forth in claim 6 wherein said plurality of dental tools comprises at least a pick, a carver, and a drill.

8. (Original) The method set forth in claim 6 wherein said plurality of dental tools comprises at least a pick, a carver, a drill and an amalgam carrier.

9. (Original) The method set forth in claim 1 wherein said display device renders said model of a tooth and said model of a dental tool in a stereoscopic three dimensional display.

10. (Previously presented) The method set forth in claim 1 wherein said a haptic interface device that is manually moveable by a dental student includes a moveable force-feedback stylus that is moveable in at least three degrees of freedom.

11. (Original) The method set forth in claim 1 wherein said display device renders said model of a tooth volumetrically as a solid object consisting of a collection of volume elements.

12. (Previously presented) The method set forth in claim 11 wherein said model of a tooth is subdivided into different regions simulating different materials specified by different material type data values associated with said different regions.

13. (Original) The method as set forth in claim 1 wherein said model of a dental tool represents a drill, said method further including the step of removing portions of said model of a tooth that are intersected by said drill.

14. (Previously presented) The method as set forth in claim 1 wherein said model of a dental tool represents an amalgam carrier, said method further including the step of adding material to portions of said model of a tooth in the vicinity of said amalgam carrier.

15. (Original) The method for simulating dental procedures as set forth in claim 11 wherein said digital computer further includes means for storing volumetric object grid data specifying the attributes of at least selected ones of said volume elements.

16. (Original) The method for simulating dental procedures as set forth in claim 14 further including the step of responding the movement of said model of a dental tool with respect to said model of a tooth by modifying said volumetric object grid data.

17. (Original) The method for simulating dental procedures as set forth in claim 15 further including the step of responding the movement of said model of a dental tool with respect to said model of a tooth by modifying said volumetric object grid data and said data specifying the attributes of at least selected ones of said volume elements.

18. (Original) The method for simulating dental procedures as set forth in claim 17 wherein said digital computer further includes means for storing data for representing the shape and character of a modification region of said model of a dental tool to control the manner in which said volumetric object grid data is modified.

19. (Previously presented) Apparatus for simulating dental procedures for training a dental student comprising, in combination, a digital computer consisting of at least a processor, a display device, a haptic interface including a moveable force-feedback stylus manipulatable by said student, and storage means for storing:

volumetric object grid data for representing a tooth as the position and attributes of a collection of volume elements in three-dimensional space,

tool definition data for representing the position of feel points on the surface of a dental tool in three-dimensional space, and

a simulation program executable by said processor in response to the movement of said stylus for moving a displayed model of said dental tool with respect to a displayed model of said tooth and for comparing the position of said feel points to the position of said volume elements for calculating and applying computer-controlled interaction forces to said force-feedback stylus to simulate the feel of said dental tool to haptically simulate a dental procedure.

20. (Canceled)

21. (Canceled)

22. (Previously presented) Apparatus as set forth in claim 19 wherein said tool definition data specifies the shape and location of a modification region of said dental tool and wherein said simulation program includes means for modifying said object grid data for volume elements in the vicinity of said modification region.

23. (Previously presented) Apparatus as set forth in claim 22 wherein said simulation program further includes means for modifying said object grid data representing said attributes of said volume elements in the vicinity of said modification region.

24. (Previously presented) Apparatus as set forth in claim 23 wherein said simulation program includes means for increasing said interaction forces applied to said stylus when said at

least one of said feel points is moved near to one or more of said volume elements representing said tooth.

25. (Previously presented) Apparatus as set forth in claim 24 wherein at least some of said feel points define the location of a handle portion of said dental tool.

26. (Original) Apparatus as set forth in claim 24 wherein at least some of said feel points are positioned outwardly from said modification region to increase the amount of force that the student must apply to said stylus to modify data representing said tooth.

27. (Original) Apparatus as set forth in claim 24 wherein at least some of said feel points are positioned inwardly into said modification region to decrease the amount of force that the student must apply to said stylus to modify data representing said tooth.

28. (Original) Apparatus as set forth in claim 24 wherein as least some of said feel points are spaced from adjacent ones of said feel points by a distance larger than the dimension of projecting portions of said tooth thereby facilitating the removal of said projecting portions.

29. (Original) Apparatus as set forth in claim 24 wherein at least some of said feel points are positioned relative to said modification region to guide the movement of said modification region with respect to said model of a tooth.

30. (Original) Apparatus as set forth in claim 23 wherein said tool definition data further includes the specification of the location of one or more sensor points relative to said modification region for determining the attributes of volume elements of said tooth located at said sensor points.

31. (Original) Apparatus as set forth in claim 30 wherein said tool definition data includes the specification of the location of a single sensor point located substantially at the center of mass of said modification region.

32. (Original) Apparatus as set forth in claim 30 wherein said tool definition data further includes the specification of the location of one or more sensor points at or near the location of one or more selected ones of said feel points for determining the attributes of volume elements of said tooth at said sensor points.